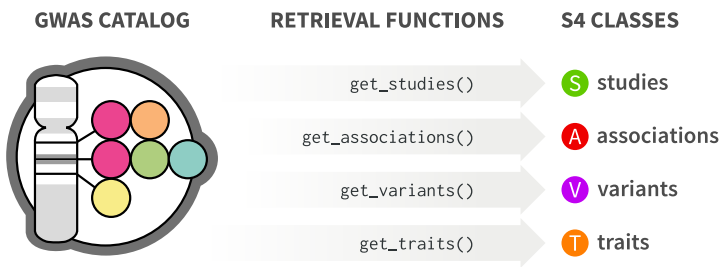# GWAS Catalog access with gwasrapidd

Introduction

The **GWAS Catalog** is a service provided by the EMBL-EBI and NHGRI that offers a manually curated and freely available database of published genome-wide association studies (GWAS).

The GWAS Catalog data provided by the **RESTful API** is organized around four core entities:

- **studies**
- **associations**
- **variants**
- **traits**

Get GWAS Catalog Entities

gwasrapidd facilitates the access to the Catalog via the RESTful API, allowing you to programmatically retrieve data directly into R. Each of the four entities is mapped to an S4 object of a class of the same name.

GWAS CATALOG	RETRIEVAL FUNCTIONS	S4 CLASSES
	get_studies()	S studies
	get_associations()	A associations
	get_variants()	V variants
	get_traits()	T traits

Search by	Example	S	A	V	T
study_id	"GCST000858"	●	●	●	●
association_id	"24300113"	●	●	●	●
variant_id	"rs12752552"	●	●	●	○
efo_id	"EFO_0005543"	●	●	●	●
pubmed_id	"21626137"	●	●	●	●
user_requested	TRUE	●	○	○	○
full_pvalue_set	FALSE	●	○	○	○
efo_uri	"http://www.ebi.ac.uk/efo/EFO_0004761"	●	○	○	●
genomic_range	list(chromosome = "22", start = 1L, end = 15473564L)	○	○	●	○
gene_name	"BRCA1"	○	○	●	○
efo_trait	"lung adenocarcinoma"	●	●	●	●
reported_trait	"Breast cancer"	●	○	●	○
cytogenetic_band	"1p36.33"	○	○	●	○

S4 Representation of GWAS Catalog Entities

S4 class studies

The `studies` object consists of eight slots, each a table (tibble). Each study is an observation (row) in the `studies` table — main table. All tables have the column `study_id` as primary key.

For details about the studies S4 class: `class?studies`.

studies
- study_id
- reported_trait
- initial_sample_size
- replication_sample_size
- gxe
- gxg
- snp_count
- qualifier
- imputed
- pooled
- study_design_comment
- full_pvalue_set
- user_requested

genotyping_techs
- study_id
- genotyping technology

platforms
- study_id
- manufacturer

ancestries
- study_id
- ancestry_id
- type
- number_of_individuals

ancestral_groups
- study_id
- ancestry_id
- ancestral_group

countries_of_recruitment
- study_id
- ancestry_id
- country_name
- major_area
- region

countries_of_origin
- study_id
- ancestry_id
- country_name
- major_area
- region

publications
- study_id
- pubmed_id
- publication_date
- publication
- title
- author_fullname
- author_orcid

S4 class associations

The `associations` object consists of six slots, each a table (tibble). Each association is an observation (row) in the `associations` table — main table. All tables have the column `association_id` as primary key.

For details about the associations S4 class: `class?associations`.

associations
- association_id
- pvalue
- pvalue_description
- pvalue_mantissa
- pvalue_exponent
- multiple_snp_haplotype
- snp_interaction
- snp_type
- standard_error
- range
- or_per_copy_number
- beta_number
- beta_unit
- beta_direction
- beta_description
- last_mapping_date
- last_update_date

loci
- association_id
- locus_id
- haplotype_snp_count
- description

risk_alleles
- association_id
- locus_id
- variant_id
- risk_allele
- risk_frequency
- genome_wide
- limited_list

genes
- association_id
- locus_id
- gene_name

ensembl_ids
- association_id
- locus_id
- gene_name
- ensembl_id

entrez_ids
- association_id
- locus_id
- gene_name
- entrez_id

S4 class variants

The `variants` object consists of four slots, each a table (tibble). Each variant is an observation (row) in the `variants` table — main table. All tables have the column `variant_id` as primary key.

For details about the variants S4 class: `class?variants`.

variants
- variant_id
- merged
- functional_class
- chromosome_name
- chromosome_position
- chromosome_region
- last_update_date

genomic_contexts
- variant_id
- gene_name
- chromosome_name
- chromosome_position
- distance
- is_closest_gene
- is_intergenic
- is_upstream
- is_downstream
- source
- mapping_method

ensembl_ids
- variant_id
- gene_name
- ensembl_id

entrez_ids
- variant_id
- gene_name
- entrez_id

S4 class traits

The `traits` object consists of one slot only, a table (tibble) of GWAS Catalog EFO traits. Each EFO trait is an observation (row) in the traits table — main table.

For details about the traits S4 class: `class?traits`.

traits
- efo_id
- trait
- uri

Manipulate Cases

Get a **studies** object **s** of two GWAS studies:

```
s <- get_studies(study_id = c('a', 'b'))
```

Subset object **s** by either identifier or position using `[`:

```
s['a'] # Subset by identifier
```

```
s[1] # Subset by position
```

Combine two studies' objects:

s1 + **s2**

union(s1,s2)
(Discards duplicates)

bind(s1,s2)
(Keeps duplicates)